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Agglomeration economies, taxable rents and government capture: evidence from a place-based policy

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Abstract

We study how industry-level agglomeration economies affect government policy. Using administrative data on firm subsidies in economically lagging regions of Great Britain, we contrast two alternative hypotheses. Economic geography models imply that firms at an industry's core can sustain higher tax burdens or require lower subsidies than firms in more remote locations. Conversely, political economy models predict firms at the industry's core to be more successful at lobbying government, particularly at the subnational level, thus obtaining more favourable fiscal treatment. Our evidence suggests that local government agencies structure subsidy offers to favour pre-existing employment in locally agglomerated industries, behaviour more in line with theories of policy capture than with economic geography models. Grants administered by central government agencies, however, conform more strongly with the predictions of economic geography models.

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1. Introduction

Probably the most important policy-relevant insight generated by the recent theoretical literature in economic geography is that, in a world of low trade costs and mobile capital, agglomeration economies can tie firms to certain locations and thereby generate taxable rents. If agglomeration forces are sufficiently strong and governments are aware of them, the race to the bottom in capital taxation, a typical feature of neoclassical tax competition models, may not happen.[1] Building on a number of prior theoretical contributions, this point was made prominently by Baldwin and Krugman (2004), who found that the government of a jurisdiction that hosts a cluster of mobile industry will

1 Think of the 'race to the bottom' as the combination of strategic complementarity among tax rates of competing jurisdictions and increasing capital mobility. Agglomeration forces then can act as a *de facto* constraint on capital mobility.

act like a limit-pricing monopolist, extracting a fiscal rent from its *de facto* immobile tax base up to the point where it can just hold on to the agglomeration in the face of a low-tax competitor.[2] This argument has had a considerable impact on policy thinking.[3]

Agglomerations of firms, however, could conceivably have the exact opposite effect on local taxation, if, rather than having some of their agglomeration rents taxed away, they instead were able to exploit their bargaining position to exert political influence on local government and obtain favourable treatment. The political economy literature points to such policy capture as being stronger at the local level than at the national level (Bardhan and Mookherjee, 2000; Bardhan, 2002; Redoano, 2010). It also suggests that incumbent declining firms and industries expend greater lobbying effort than entrants (Brainard and Verdier, 1997; Baldwin and Robert-Nicoud, 2007), and that geographically concentrated industries are particularly active in seeking to influence policy (Busch and Reinhardt, 2000).

In this article, we examine how government policy reacts to agglomeration economies by contrasting these alternative theories. We analyse the generosity of a place-based subsidy scheme, which aims to induce firms to locate jobs in economically lagging, and sometimes remote regions away from existing agglomerations. Subsidies can be thought of as negative taxes, and applicants can be categorised by the agglomeration intensity of the industry they belong to.[4]

Our empirical investigation uses administrative data on a major place-based policy in Great Britain, from which we can exploit detailed information on both applications for grants by firms and subsequent grant offers by policy authorities. Political economy models suggest that capture may be more prevalent at lower tiers of government. Thus, we pay particular attention to applications made to subnational policy authorities. For a sample of applications to the English regional policy authorities, we find evidence that authorities appear to be structuring their offers so as to favour, and potentially try and preserve, existing employment in more agglomerated industries in areas with a higher concentration of industry employment, and where employment in that industry-region is in relative decline. While more than one theoretical mechanism could in principle be at play, and hence our results capture a combination of these, such behaviour is more consistent with models of local policy capture by incumbent firms, than with either government appropriation of agglomeration rents or government promotion of high-growth clusters. In contrast, applications to, and offers made by, the national policy authorities in England, Scotland and Wales appear to be more in line with the predictions emanating from economic geography models.

Our analysis addresses two identification problems which complicate the empirical examination of the hypothesis that governments tax agglomeration rents. The first is two-way causation. In economic geography models, tax rates depend on the location of the tax base, as in our hypothesis, but the location of the tax base also depends on tax rates. A regression of location-specific tax rates on location-specific measures of

2 Other important theoretical treatments of this idea include Ludema and Wooton (2000), Kind et al. (2000), Andersson and Forslid (2003), Borck and Pflüger (2006) and Konrad and Kovenock (2009). For an overview, see Baldwin *et al*. (2003, chapters 15 and 16).

3 In a discussion of the Baldwin-Krugman paper, *The Economist* (29 March 2001) summarised the key point as follows: '(i)f policymakers accept the benefits of agglomeration, one big argument for tax harmonisation falls apart'.

4 For a model of agglomeration and taxation that allows taxes to be positive or negative, see Haufler and Wooton (2010).

agglomeration will likely suffer from simultaneity bias, unless valid instruments are found for agglomeration. We partly circumvent this issue by taking a fiscal variable that is specific to firms, and by regressing that variable on an industry-specific agglomeration measure. In this setting, reverse causation (whereby the subsidy paid to an individual firm would impact on the pre-existing degree of agglomeration of that firm's industry) is not a plausible concern.

The second problem arises from the potential for omitted variables: taxes (and subsidies) depend on tax bases but also on other factors such as revenue needs and voter preferences. A regression of location-specific tax rates on location-specific measures of agglomeration can never be entirely free of the suspicion that some relevant right-hand side variable is missing. This is of particular concern since, in the data, 'agglomerated' locations usually correspond to urban areas, and urban areas tend to have higher revenue needs for a host of reasons. Hence, any estimate suggesting that larger or denser regions levy higher taxes will inevitably be tainted by the omitted-variable suspicion. Our approach to this issue is to estimate the hypothesis at least in part not across locations but across industries.[5]

The hypothesis that governments tax agglomeration rents has been explored empirically.[6] All of the existing studies use a cross-location regression design, and all of them conclude that observed tax rates are higher in places that are host to an agglomeration. Buettner (2001) finds that more populous German municipalities set higher local business tax rates, and Charlot and Paty (2007) find that French municipalities with greater market potential do likewise.[7] More recently, the reverse-causation problem has been addressed by instrumenting the right-hand-side agglomeration measure with agglomeration measured at a date prior to the introduction of the tax that represents the left-hand-side variable (Jofre-Monseny, 2013; Koh et al., 2013; Luthi and Schmidheiny, 2014).

Our study builds on two precursor papers. Brülhart et al. (2012) use the cross-industry dimension to test the hypothesis that firm births in more agglomerated industries are less sensitive to regional tax differences than firm births in less agglomerated industries. Their analysis uses Swiss data, where tax rates are sector invariant, and finds that agglomeration has a statistically significant but quantitatively rather modest attenuating effect on the tax sensitivity of firms' location choices. In the present article, we take advantage of a policy setting where the subsidy can be varied across industries, to test whether the rate offered takes account of firms' differential spatial mobility according to the extent of industry localisation. We also build on Devereux et al. (2007), who examined whether plant location choices in Great Britain are actually influenced by the availability of regional subsidies. They find that, other things equal, entrant location decisions are more responsive to financial incentives in

5 Concerns about omitted variables in the cross-industry dimension may of course still apply. We discuss this below.

6 See Brülhart et al. (2015, section 17.5) for a survey.

7 The same basic regression design is applied to international data by Garretsen and Peeters (2007), who report that effective average tax rates on corporate income across OECD countries correlate positively with country size and market potential. In a similar vein, Carlsen et al. (2005) find that, other things equal, Norwegian municipalities set higher infrastructure fees if their local economies are dominated by firms in immobile sectors.

areas with pre-existing industry activity compared to more peripheral locations.[8] Our research question in this article differs in that we focus on how the subsidy applied for by firms and the amount then offered by the government vary with the degree of *industry* agglomeration.[9]

The article is structured as follows. In Section 2, we describe the policy setting and data. Section 3 sets out the theoretical background and empirical strategy. Section 4 presents the results and Section 5 concludes.

2. Policy background and data

2.1. British regional grant schemes

The policies we exploit are the Regional Selective Assistance (RSA) and Enterprise Grant schemes in Great Britain (see NAO, 2003; Wren, 2005; Devereux et al., 2007 and Criscuolo et al., 2012) over the period 1985–2004.[10] These are discretionary schemes which offer grants to firms with the stated aim of creating or safeguarding employment in specific economically disadvantaged areas. A further official aim of the RSA scheme is to attract internationally mobile investment.

The government agency which administered each scheme, and hence determined the level of grant offered, depended on the value and location of the grant application. For England, only large applications (above GBP 1 million up to 1996, and above GBP 2 million thereafter) were administered by central government in London, while all smaller projects were handled by the authorities of the nine English administrative regions. Decisions are typically made by formally independent boards comprised of appointed representatives from the private and public sectors and working closely with government officials. All projects located in Scotland and in Wales were handled by their respective government offices. Budgets for the various schemes were allocated centrally in London, with the scheme budgets being 'based around historical demand [for the scheme] and affordability conditions' (National Audit Office, 2003, 17).

Grants could only be paid to projects located in specific 'Assisted Areas', characterised by relatively low income per capita, low labour market participation and/or high unemployment rates. Assisted Areas were further classified into three 'Tiers' depending on their perceived economic needs. Tier 1 (Development Areas) were the most deprived and qualified for the highest subsidy rates, Tier 2 (Intermediate Areas) qualified for lower rates and in Tier 3 areas firms could only apply for Enterprise Grants. Assisted-Area status was assigned in roughly 5-year intervals (1984–1988, 1988–1993, 1994–1999, 2000–2006), according to European Union (EU) rules on area characteristics. Assisted Areas are typically, although not always, in peripheral

8 Briant et al. (2015), studying the effects of 'enterprise zones' in France similarly find that place-based policies are less effective in terms of employment creation when deployed at relatively remote locations. A comparable result is also found by Henderson (1994). Studying locational choices and subsidies to new firms in Brazil, he finds that, for a given amount of subsidy, more additional activity can be generated in cities where other firms of the same industry are already present than in cities without an established industry.

9 In addition, we use more comprehensive administrative data on both grant applications and offers to a much wider set of entrant and incumbent plants, made under the same programme.

10 After 2004, both schemes were replaced by a new programme in England; hence, our sample ends in that year.

locations remote from industrial centres, as they mainly cover coastal areas of Scotland and Wales and the South West of England.[11]

Eligible applicants included both pre-existing plants in Assisted Areas, which could apply for grants to either expand employment or safeguard existing jobs, and new plants that considered locating in those areas. Around 90% of applicants were in the manufacturing sector (DTI, 2003). RSA grants were available for up to a set fraction of eligible project costs, which included investment in plant and machinery, land and buildings. The programme was targeted at marginal projects, in the sense that a grant needed to be necessary for the project to go ahead on the scale proposed, and the government agency aimed to award the minimum grant necessary for the project to proceed—often below the maximum grant rate permitted under EU legislation. Applicants could submit proposals in only one location within Great Britain.

2.2. Data

We use information on all applications filed and offers made in Great Britain under these schemes from 1985 to 2004, although the data on the Enterprise Grant scheme only cover England and Scotland. Nearly 90% of applicants in our data received an offer. The information includes the amount of grant applied for, together with the number of jobs to be created and/or safeguarded as stated in the application. The data also include information on the value of the of grant offered, the associated number of jobs to be safeguarded and/or created as estimated by the government, as well as the capital costs associated with the offer. In order to account for further parameters of the policymaking process, and variation in these over time, we also use data on the Tier to which Assisted Areas are classified and on the maximum grant rate allowable in specific locations (postcodes) as mandated by the EU.[12] The data also allow us to distinguish between applications made to the different policy authorities using information on the location and value of the application. For our main estimation sample we use the set of

11 A map showing Assisted Areas for 2007–2013, is available here: http://webarchive.nationalarchives.gov.uk/20081109123403/http://www.berr.gov.uk/files/file38644.png. Our industry peripherality measure (described in Section 2.2) averaged across the population of plants in England, Wales and Scotland, takes a mean value of 96.172 in Assisted Areas, and 95.772 in non-Assisted Areas, indicating that on average plants in Assisted Areas are located at a greater distance from employment in their own industry. Assisted Areas are also eligible for EU Structural Fund infrastructure expenditure, which will in principle benefit *all* firms within an area. Expenditure will vary with Tier 1 versus Tier 2 status, which we control for in analysis. Assisted Areas can also overlap with Enterprise Zones, which provide business assistance and subsidies. However, these are very small brownfield sites of less than 0.5 km^2 and hence will not affect the vast majority of plants in our analysis. Other smaller schemes in operation during the early years of our sample period included Regional Innovation Grants/SMART (R&D assistance schemes) and Regional Investment Grants available in specific coal closure areas. Both were only open to small firms, and expenditure was very low compared to RSA. Our data include an indicator variable of whether or not an applicant is in receipt of another form of public assistance. When we include this in our main regressions it is never significant and does not affect our main results.

12 Assisted Area eligibility and Tier designation are defined using different spatial units in different periods. Prior to 2000 'Travel to Work Areas' were used (see footnote 18). From 2000 onwards, smaller, administrative electoral wards were used. The EU sets a maximum admissible grant rate in terms of the 'Net Grant Equivalent', which is a percentage of the investment after corporate tax. The maximum grant rate can vary within a Tier. For example, within Tier 2 areas it varied according to area GDP, unemployment and population density, and according to whether or not the area adjoined a Tier 1 area. Hence, we use data on maximum grant rates at a finer spatial level than the level of the Tier or TTWA. These data were obtained alongside the individual grant application and offer data from the Department of Business, Innovation and Skills.

applications to English regional policy authorities, but as a complement we also consider those administered by the respective national policy authorities (Scotland and Wales and the English central government body).

Our second information source is the plant and establishment-level data from the British Annual Respondents Database (ARD), where an establishment can comprise one or more plants under common ownership in the same line of business.[13] We use data for the manufacturing sector from 1984 to 2006.[14] We link the data on government grants to the ARD at the plant or establishment level. Appendix A provides more detailed information on the matching, and on how we deal with matches to multi-plant establishments.

We use the plant-level population data to construct measures of the characteristics of the applicant plant and its parent firm. These include three indicator variables: an indicator of whether the plant is owned by a foreign multinational; an indicator of whether it is part of a multi-plant firm; and an indicator of whether the plant is a greenfield entrant. We also construct a measure of total manufacturing employment within the remainder of the firm, that is, excluding the plant with which the application is associated. This therefore takes the value zero for all single-plant firms (i.e. plants that are not part of a larger group with manufacturing activity in Great Britain). These variables are all dated year t. We also construct a measure of plant-level employment growth over the previous period ($t-1$ to t).[15] The plant-level data also contain information on the plant's five-digit industry, and on its precise location (full postcode), which allows us to locate it within a Travel to Work Area (TTWA). When we assign a location to a grant application we assign the postcode at which the actual project will take place using the information in the ARD (and not the postcode supplied in the administrative grant applications data, which can sometimes be the postcode for the applicant firm's headquarters).

To measure the degree to which each industry is localised, we use the Ellison and Glaeser (1997) EG index of agglomeration. We calculate this at the five-digit industry level for each year.[16] In our empirical analysis, for ease of interpretation, we convert this to a standardised measure, with mean zero and standard deviation of 1 for each estimation sample. We construct further five-digit industry-level measures which reflect the policy process and which more generally might be correlated with the size of grants applied for and offered. Based on the establishment-level sample, we construct measures of the investment intensity of the industry (defined as investment in physical capital—plant and machinery, buildings and land and vehicles—per worker), and of the skill intensity of the industry (defined as the skilled-to-unskilled worker wage bill ratio).

13 See Barnes and Martin (2002) and Griffith (1999) for a full description. Firms are legally required to respond to the survey.

14 The year 1984 is the first year for which postcode-level location information is available.

15 This is defined as (employment_{it} – $\text{employment}_{it\text{-}1}$) / $\text{employment}_{it\text{-}1}$ and is set equal to zero for new entrants.

16 The Ellison and Glaeser (1997) index for an industry is given by: $\gamma = \left\{ \frac{\sum_{r=1}^{R} (s_r^2 - x_r^2)}{1 - \sum_{r=1}^{R} x_r^2} - H \right\} / (1 - H)$, where s_r and x_r are the share of industry employment and total manufacturing employment in region r, respectively, and H is the industry Herfindahl index.

We use the plant-level sample to measure average employment growth and average plant age, across plants within each industry-year.[17]

Finally, we construct location-specific variables based on 303 TTWAs.[18] We measure the straight line distance between the centres of each possible pair of TTWAs and construct indicators of whether TTWAs are within a given radius of each other. As a measure of the industry-specific remoteness of a TTWA, we calculate the percentage of total industry employment that lies in TTWAs outside a 25-km radius from the TTWA centre, referring to this measure as 'industry peripherality'.[19] We again convert this to a standardised measure with mean zero and standard deviation of 1 for use in the regression analysis. We additionally control for the mean industry wage by TTWA and year, and the unemployment rate (claimant count) by year and broad administrative region (nine regions within England, plus Wales and Scotland).

Descriptive statistics on all our variables, for our main estimation sample of applications to English regional policy authorities, are provided in Table 1. The table shows that the average amount applied for (measured in 2005 GBP) was around £143,000, with the average offer made by government at around £112,000. Part of the reason for this difference is that the number of jobs to be created or safeguarded that are stipulated in the government offer is typically lower than that which the firm had specified at the application stage. The majority of offers (74%) are made to firms that are only creating new jobs, rather than only protecting existing ones, although some grants involve both. Thirty percent of applicants are part of multi-site firms and around 5% are owned by foreign multinationals. There is also considerable variation in the degree of industry localisation as measured by the EG index, and our measure of industry peripherality implies that on average 93% of industry employment lies outside TTWAs within a 25-km radius from the centre of the TTWA in which an applicant is located.

3. Theoretical background and empirical strategy

In this section, we contrast alternative theoretical models of government behaviour in terms of subsidy offers across more or less agglomerated industries and regions, and across different tiers of government. We derive our empirical predictions from these models.

3.1. Economic geography

Economic geography models suggest that a purely benevolent government, either national or regional, will pay more per job to attract a given firm to a peripheral region if the firm belongs to an industry with relatively strong returns to spatial agglomeration. This can be represented by the following simple model. Suppose that a government's policy objective is to maximise the number of jobs generated within its jurisdiction, that is, either at a national level or within a region. Moreover, suppose that the government

17 Plant age is truncated as the earliest year in which we can observe plants in is 1973.

18 These are area definitions based on commuting patterns designed to capture local labour markets. The UK Office for National Statistics provides a formal definition. http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/other/travel-to-work-areas/index.html

19 In Appendix Table D3, we report robustness to alternative measures.

seeks a certain diversity of jobs across firms.[20] This can most simply be represented by an objective function such as the standard constant-elasticity specification:

$$U^{gov} = ln\left(\sum_i \delta_i e_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} + G, \sigma > 1, \tag{1}$$

where i denotes firms, e_i is the number of jobs created in the jurisdiction, δ_i is a parameter expressing particular preferences for or against certain firms, σ is the elasticity of substitution between jobs in different firms (and thus an inverse measure of the government's taste for industrial diversity) and G summarises government services other than its regional job creation policy.

Assuming a balanced budget, the government will face the following constraint:

$$T = \sum_i e_i c_i + G, \tag{2}$$

where T is government revenue, c_i is the cost to the government of attracting a firm-i job, and where the cost to the government of supplying G is normalised to unity. We think of c_i as the government's best guess of the minimum per-job subsidy required for firm i to locate in the government's preferred jurisdiction.

Maximisation of Equation (1) subject to Equation (2) yields the following subsidy per firm, S_i:

$$S_i = c_i e_i = \frac{c_i^{1-\sigma}\delta_i^{\sigma} T}{\sum_j c_j^{1-\sigma}}. \tag{3}$$

The derivative of S_i with respect to c_i is negative. Hence, for a higher required per-job subsidy c_i, the government pays more *per job* but less *per firm*.

We can write c_i as $c_i = g(\mathbf{W}_i, \mathbf{X}_s, \mathbf{Y}_r, \mathbf{Z}_{rs})$, where s denotes industries, r denotes local labour market areas within the periphery, $\mathbf{W}_i$ is a vector of firm-specific attributes, $\mathbf{X}_s$ is a vector of industry-specific attributes, $\mathbf{Y}_r$ is a vector of area-specific attributes and $\mathbf{Z}_{rs}$ is a vector of industry area-specific attributes. Assuming linearity and considering a panel with t indexing years, our basic empirical specification for $c_{i=}c_{isrt}$ can be written as:

$$c_{isrt} = \alpha + \mathbf{W}_{it}\boldsymbol{\beta}_1 + \mathbf{X}_{st}\boldsymbol{\beta}_2 + \mathbf{Y}_{rt}\boldsymbol{\beta}_3 + \mathbf{Z}_{rst}\boldsymbol{\beta}_4 + T_t + J_j + P_p + e_{isrt}, \tag{4}$$

where T_t is a set of time dummies to reflect general variation in the generosity of the policy over time, J_j are a set of broader two-digit industry dummies and P_p is a set of dummy variables representing the jurisdictional policy authority that is making the offer.

Our main focus is on one element of $\mathbf{X}_{st}$: the agglomeration intensity of individual industries, which we denote with A_{st}. The central hypothesis emerging from economic geography models is that the higher the agglomeration intensity of an industry, the

20 This taste for diversity could result from a desire to mitigate exposure to firm-specific shocks or from a perception that diversity of firms has other economic or non-economic benefits. Note that if we assumed that the government is perfectly indifferent about the firm in which jobs are created, and abstracting from firm-level capacity limits, the government would concentrate all its subsidies on the firm with the lowest perceived cost per job. Note also that a taste for diversity across firms implies a taste for diversity across industries.

Table 1. Descriptive statistics: applications to English regional authorities

Variable	Mean	Standard deviation	10th percentile	90th percentile
Application characteristics				
Application amount$_i$ (£1000)	142.997	264.027	13.998	312.635
Dummy job creation only application$_i$	0.630	0.483	0	1
Dummy jobs safeguarded only application$_i$	0.051	0.220	0	0
Estimated new jobs at application$_i$	17.724	30.154	2	40
Estimated safeguarded jobs at application$_i$	12.570	40.755	0	30
Offer characteristics				
Offer amount$_i$ (£1000)	112.242	214.232	12.084	257.274
Capital costs$_i$ (£1000)	815.051	1949.754	64.185	1816.242
Dummy job creation only offer$_i$	0.743	0.437	0	1
Dummy jobs safeguarded only offer$_i$	0.056	0.229	0	0
New jobs associated with offer$_i$	16.060	27.244	2	36
Safeguarded jobs associated with offer$_i$	10.092	36.688	0	24
Firm characteristics				
Dummy multi-plant firm$_i$	0.298	0.457	0	1
Total employment in firm$_i$	434.439	3113.596	0	266
Foreign-owned MNE$_i$	0.045	0.208	0	0
Entrant$_i$	0.391	0.488	0	1
Employment growth$_{it\text{-}1}$	0.402	2.861	−0.058	0.951
Industry characteristics				
EG index$_{st\text{-}1}$ [raw]	0.019	0.040	0.001	0.044
EG index$_{st\text{-}1}$ [standardised]	0.000	1.000	−0.430	0.627
Real investment per worker$_{st\text{-}1}$ (£1000)	3.735	3.062	1.437	6.546
Skilled/unskilled worker wage bill ratio$_{st\text{-}1}$	0.849	0.090	0.802	0.917
Mean plant age$_{st\text{-}1}$	6.704	2.337	3.768	9.837
Mean employment growth$_{st\text{-}1}$	−0.004	0.370	−0.238	0.161
Area and area-industry characteristics				
Dummy Tier 1 Assisted Area$_{rt}$	0.433	0.496	0	1
Maximum grant rate$_{rt}$	0.227	0.075	0.150	0.300
Real industry wage$_{srt\text{-}1}$ (£1000)	19.393	4.475	14.836	24.011
Claimant count rate$_{rt\text{-}1}$ (%age)	5.851	1.950	3.000	7.900
Industry peripherality$_{srt\text{-}1}$ [raw]	93.235	10.161	82.162	99.684
Industry peripherality$_{srt\text{-}1}$ [standardised]	0.000	1.000	−1.090	0.635
Industry peripherality$_{srt\text{-}1}$ [raw] × EG index$_{st\text{-}1}$ [raw]	1.541	2.690	0.128	3.855
Industry peripherality$_{srt\text{-}1}$ [stsd] × EG index$_{st\text{-}1}$ [stsd]	−0.491	4.682	−0.262	0.203

Note: all statistics calculated across 4264 applications to English regional policy authorities.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

lower is the sensitivity of firms in that industry to locational determinants other than the distribution of existing same-industry firms.[21] Subsidies are one such 'other' locational determinant. Hence, provided that the locus of the industry's agglomeration is in the central region, the required *per-job* subsidy at a peripheral location will be higher for firms in more agglomerated industries: $\frac{\partial c_i}{\partial A_s} > 0$. Conversely, according to

21 For a formal derivation of this result, see Brülhart et al. (2012).

Equation (3), the subsidy paid *per firm* will be lower for firms in more agglomerated industries: $\frac{\partial S_i}{\partial A_s} < 0$.[22]

Prediction 1 (economic geography): *Firms in more agglomerated industries attract higher subsidies per job but lower subsidies per firm.*

In our empirical analysis the relationship between subsidy rates and the degree of industry agglomeration is identified from cross-industry variation. It is therefore important that we control for other industry-level factors that may be correlated with the size of grant applications and offers. As discussed in Section 2, we aim to control for a range of characteristics at the plant, firm, industry and area level that capture different potential correlates of the policy.

One source of within-industry heterogeneity is the proposed or pre-existing location of the plant relative to the geographical core of the industry. Empirically, the locus of agglomeration will be different across industries, and may, for some of them, even lie within the set of peripheral regions that are eligible for subsidies. Our second focus is on an element of $\mathbf{Z}_{rst}$, an interaction term between A_{st} and D_{rst}, where the latter is a measure of geographic distance to existing activity in the industry. We expect the coefficient on the interaction term to be positive, $\frac{\partial^2 c_i}{\partial A_s \partial D_{rs}} > 0$ implying that as industry agglomeration increases, applicants located further away from existing employment in the industry—and hence less likely to benefit from industry agglomeration economies—receive higher offers per job. Put differently, the more agglomerated an industry, the more expensive it should be to create or retain jobs in a region far away from the locus of the industry.

Prediction 2 (economic geography): *Firms located close to their industry's geographical core attract lower subsidies per job. This effect is stronger the more agglomerated the industry*.

Predictions 1 and 2 capture the economic geography result that governments tax agglomeration rents, applied to a setting with subsidies.

3.2. Policy capture

The alternative model of government behaviour we consider is policy capture by rent-seeking firms. There is evidence to suggest that lobbying and political mobilisation increase when the degree of industry agglomeration is higher (Busch and Reinhardt, 2000). Indeed it is quite plausible that in areas that exhibit stronger industrial specialisation the local bargaining power of firms belonging to predominant sectors might be greater, as larger groups are more likely to organise into a lobby (Redoano, 2010). Taken together, these arguments imply that firms in more agglomerated

22 The latter effect is not generic to all geography models. Burbidge and Cuff (2005) and Fernandez (2005) have studied tax competition in models featuring increasing returns to scale that are external to firms, with firms operating under perfect competition. In these models, individual firm mobility is not constrained by agglomeration economies and governments may compete even more vigorously to attract firms than in the standard tax competition model. Krogstrup (2008) shows that for tax competition to be intensified, external agglomeration economies must be relatively weak, in the sense that they are outweighed by dispersion forces that stabilise the overall spatial allocation of activity. Our working hypothesis is that agglomeration economies are sufficiently internalised by firms to affect firms' locational sensitivity to tax differentials.

industries might in fact have greater scope to extract rents from policymakers in the region(s) where the industry is localised.[23] In this case, we would expect the coefficient on the interaction term discussed above to take the opposite sign, $\frac{\partial^2 c_i}{\partial A_s \partial D_{rs}} < 0$. That is, as the degree of industry agglomeration rises, per-job subsidies would be expected to be increasing in geographic proximity to industry employment—the reverse of Prediction 2.

Prediction 3 (policy capture): *Firms located close to their industry's geographical core attract higher subsidies per job. This effect is stronger the more agglomerated the industry.*

By pitting Prediction 3 against Prediction 2, we have a direct test of which mechanism dominates. Note that domination does not imply uniqueness: even if the data clearly support one of the two predictions, this does not mean that the mechanism underlying the other is necessarily absent. Put differently, our test is about the relative strength of the two opposing forces and not only about their existence. In reality, both mechanisms are plausibly at play.

Our straightforward discriminating criterion has methodological appeal but runs the risk of oversimplification. Economic geography models could in principle imply relatively higher subsidies at the locus of an industrial cluster because industry productivity is higher there: if workers are more productive in agglomerations, firms will require larger subsidies to pay their marginal product.[24] Hence, a government's objective function, unlike our simple model in Equation (1), might include not only the number of jobs but also their productivity, giving the policymaker an incentive to favour employment at industry agglomerations.[25] We therefore consider two additional features of policy capture models that do not feature in economic geography models.

The first feature is that the jurisdictional level of government matters. Political economy models imply that lobbying may be more successful at a local rather than at a national level, as voters may be less well informed by the media about the actions of local governments than about those of the national government (due, for instance, to less intensive competition among media organisations at the local level); and interests may be easier to organise locally (Bardhan and Mookherjee, 2000; Bardhan, 2002). Local-level lobbying may also be easier due to a 'preference dilution effect' at the national level, where firm-level preferences are more heterogeneous than at the local level (De Melo et al., 1993; Redoano, 2010).

23 A similar logic, though in a different setting, is modelled by Brueckner and Neumark (2014). They analyse a setting where local public sector workers are able to extract higher rents in locations with more attractive amenities, as the presence of those amenities makes it more costly for taxpayers to 'vote with their feet'.

24 See, for example, Rosenthal and Strange (2004) and Graham and Melo (2010) for evidence on productivity in agglomerations. In estimation we control for average wages by industry-area-year, but this might conceivably not soak up all the relevant variation.

25 A related setting is the 'million dollar plant' scenario considered in Moretti (2010) and Greenstone et al. (2010), where the main direction of agglomeration externalities is not from the surrounding industry to a given firm but from a particular (large) firm *to* the surrounding industry. For reasons set out in our concluding discussion, we consider this not to be a plausible configuration given the scale of applications in our main empirical results. Moreover, the 'million dollar plant' scenario resembles standard geography models insofar as it does not imply governments offering more generous subsidies to existing firms (as opposed to entrants), or to firms in declining (as opposed to growing) industries in their region. Hence, our Predictions 4 and 5 below are inconsistent with this setting as well.

Prediction 4 (policy capture): *Firms located close to their industry's geographical core attract more generous subsidies from regional government than from national government.*

The second feature we explore is that incumbent firms in mature or declining industries might lobby harder in the face of negative shocks, and that lobbying in such industries might persist over time (Brainard and Verdier, 1997). Baldwin and Robert-Nicoud (2007) show how the presence of sunk costs in declining industries implies that the payoff to lobbying may be higher than in growing industries, since the resulting rents are less likely to attract new entry. This behaviour on the part of incumbents would then explain the observation that 'losers' appear to be afforded greater protection by government. To examine this we look at whether incumbents seeking subsidies to protect existing employment are offered more favourable terms than plants only offering to create new jobs, and whether this is more prevalent in declining industries.

Prediction 5 (policy capture): *Firms attract higher subsidies per job the greater their focus on maintaining existing jobs, and the lower the local growth rate of their industry.*

In summary, Predictions 3 to 5 set out the hypotheses we use to evaluate the alternative model of policy capture. To take these predictions to the data, we exploit two features of the policy—whether the grant application is dealt with by a national or a regional authority, and whether the grant is to protect existing jobs or to create new ones. Moreover, we consider characteristics of the industry and location in which the application is made—whether the area is relatively specialized in that industry, and whether or not it is in relative decline.

3.3. Selection and magnitudes

One issue that may affect our empirical estimates is that firms self-select into applying for grants. Our setting therefore does not conform to the ideal of random assignment. However, there are reasons to expect selection bias not to be a significant issue in our data. First, selection into application may be on the basis of observable characteristics. If present, this source of selection would deprive us of some potentially informative observations (firms who anticipate insufficiently generous subsidies), but apart from affecting the precision of our estimates, it is hard to conceive of a mechanism through which this would bias the estimated coefficients, given the monotonic relationships implied by the theory. In Appendix B.1, we analyse selection into application on the basis of our main variables of interest, by creating a pool of *potential* applicant plants. While we find some evidence that plants more remote from industry employment are less likely to apply, we do not find that this varies with the degree of industry agglomeration.

Second, selection into application may be on the basis of unobservable characteristics, which could in principle bias our main coefficients of interest. For instance, the firms which derive the highest localisation benefits might expect the available subsidies *a priori* to be insufficient to tempt them to apply for a grant in a remote Assisted Area. Alternatively, well-informed firms (e.g. incumbents with connections to local awarding authorities) may be more likely, other things equal, to apply. However, since our primary tests are based on the *sign* of the coefficients, rather than on their precise magnitude, there is no reason to expect any under- or over-sampling as a result of selection to reverse the sign of our observed (and statistically significant) partial correlations.[26] Take, for example, Predictions 2 and 3. If Prediction 2 had more explanatory power, firms considering investments far from their industry's cluster would be more likely to apply, and if Prediction 3 were of greater empirical relevance, those firms would be less likely to apply. Among the firms that do apply because their expected subsidy exceeds the break-even point, the theory will still predict that in a world characterised by Prediction 2, those applying further away from their industry's core will attract higher subsidies, and the reverse will obtain in a world characterised by Prediction 3.[27] Selection bias may reduce the precision and magnitude of our estimated effects, but it is unlikely that a selection mechanism will reverse the qualitative relationships we are interested in.

Applicants in locations in England may also potentially select into applying to a regional policy authority rather than to the English national policy authority by choosing to apply for a subsidy below the threshold at which decision-making passes to the national authority (£1 million pre-, and £2 million post-1996). In Appendix B.2, we analyse applications on either side of the relevant threshold to see if there are systematic differences across that boundary in terms of our main variables of interest. For applications within £500,000 of the threshold we find no evidence that this is the case.

Finally, by conditioning our main offer regressions on application amounts, we eliminate potential selection biases at the offer stage. Offers being made to practically all applicants, there is no selection issue at that stage of the procedure.[28]

4. Results

In this section, we begin by examining whether firms themselves internalise industry agglomeration economies when applying for a grant, and how this is reflected in government offers. We then estimate a further set of specifications for government offers, in order to explore predictions derived from the policy capture hypothesis. We carry out our main estimations on the sample of applications to the English regional authorities, and make comparisons to the set of applications to the national government authorities to further discriminate between the predictions of the economic geography versus policy capture models.

4.1. Grant applications and offers

We first investigate the relationship between both the amount applied for and the amount offered and the degree of industry localisation. Our estimating equation takes the general form of Equation (4) above, but rather than using the per-job subsidy requested by, or offered to, the firm, we allow for some flexibility by replacing the dependent variable with the total amount applied for, a_{isrt}, or offered o_{isrt}, and

26 Our focus on qualitative effects also allows us to abstract from the precise nature of agglomeration economies. Whether firms benefit from localised knowledge spillovers, from the local pooling of specialised labour or from sharing locally available intermediate inputs, the qualitative mechanism associated with geography models and relevant to Predictions 1 and 2 is the same: firms' unit costs are lower, *ceteris paribus*, the closer they locate to the geographical core of their industry and the stronger is the agglomeration force, irrespective of its nature.

27 As noted above, the estimated coefficients can of course reflect a combination of the two opposing effects.

28 In addition, nearly all offers are accepted; further detail is provided in Appendix C.

controlling for the number of jobs to be created or safeguarded as specified at each stage among the set of firm characteristics $\boldsymbol{W}_{it}$ on the right-hand side.

We estimate specifications for the grant application and grant offer jointly using a two-equation seemingly unrelated regression (SUR) model, which allows for correlation between the two error terms. The two estimation equations take the following form:

$$a_{isrt} = \alpha_1 + \mathbf{W}_{it}\boldsymbol{\beta}_1 + \mathbf{X}_{st}\boldsymbol{\beta}_2 + \mathbf{Y}_{rt}\boldsymbol{\beta}_3 + \mathbf{Z}_{rst}\boldsymbol{\beta}_4 + T_t + J_j + P_p + \epsilon_{isrt}, \tag{5}$$

and

$$o_{isrt} = \alpha_2 + \mathbf{W}_{it}\boldsymbol{\beta}_5 + \mathbf{X}_{st}\boldsymbol{\beta}_6 + \mathbf{Y}_{rt}\boldsymbol{\beta}_7 + \mathbf{Z}_{rst}\boldsymbol{\beta}_8 + T_t + J_j + P_p + \varepsilon_{isrt}. \tag{6}$$

The results are shown in Table 2, where specifications (2) and (4) include dummy variables for the different regional policy authorities within England, akin to including broad regional dummies. The estimated coefficients on the control variables are largely as expected. For instance, per-job application values and offers are higher in the most deprived (Tier 1) Assisted Areas and more generally are increasing in the maximum admissible grant rate. Grants requested and received by foreign multinationals, and by plants that are part of larger firms are also higher. Applications and subsequent offers which specify that they will only safeguard jobs tend to be of higher value, and those which only create jobs are of lower value compared to applications that involve both. However, a greater amount is on average applied for, and offered per additional job created (around £2000 offered per job) compared to an additional job safeguarded (around £1000).

We now turn to our main variables of interest. In specifications (1) and (2), the estimated coefficient on the EG index, shown in the top panel of the table, is positive but statistically insignificant. We therefore do not find strong support for Prediction 1, whereby in economic geography models firms in industries that are more highly localised would apply for and be offered higher per-job subsidies.[29]

We also explore the second element of Prediction 1 that subsidies *per firm* should be *decreasing* in the degree of industry localisation. In Table D2 in the Appendix, we use data at the five-digit industry-year level to estimate how the value of offers at the industry level varies with the EG index, controlling for other potentially confounding industry-level characteristics as in the previous tables. Once we condition on either the total number of plants or firms in each industry-year, so that the results are informative about the generosity of subsidy offers to the average firm or plant in that sector, the coefficient on the EG index becomes insignificant, hence, again not supporting Prediction 1 whereby more agglomerated industries should receive smaller funding per firm but greater funding per job. The estimated coefficients do, however, remain negative throughout, suggesting that the economic geography mechanism may to some extent be at play.[30]

29 Appendix Table D1 checks the robustness of Prediction 1. Because the distribution of the EG index is skewed, with a small number of highly agglomerated industries, we replace the continuous measure with dummy variables indicating different percentiles of the EG index distribution (top 10%, 25% and 50%). The results are comparable to specification (2) in Table 2. We find only limited support for Prediction 1. In specification (3) in Table D1, we find that applicants in the top 50% of localised industries apply for and are offered higher subsidies per job. However, this specification is not very discriminating between agglomerated and non-agglomerated industries.

30 The coefficient in column 3 of Table D2 implies that an increase in agglomeration of 1 standard deviation is associated with a decrease in the offer per firm of £15,155 or 13.5% of the average offer (see Table 1).

Table 2. Applications and offers: seemingly unrelated regressions

Dependent variable	(1)		(2)		(3)		(4)	
	Application	Offer	Application	Offer	Application	Offer	Application	Offer
EG index$_{st\text{-}1}$	1.450	1.715	1.422	1.775	−1.535	−3.241	−1.999	−3.612
	(2.224)	(1.741)	(2.228)	(1.742)	(3.198)	(2.500)	(3.204)	(2.504)
Industry peripherality$_{srt\text{-}1}$					−0.897	0.333	−1.814	−0.451
					(2.682)	(2.097)	(2.967)	(2.319)
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$					−0.734	−1.444	−0.752	−1.474
					(0.698)	(0.546)***	(0.703)	(0.550)***
Application/Offer characteristics								
Dummy job creation only$_i$	−2.584	−3.262	−2.431	−3.501	−2.561	−3.350	−2.434	−3.612
	(3.735)	(3.398)	(3.752)	(3.403)	(3.735)	(3.395)	(3.751)	(3.400)
Dummy jobs safeguarded only$_i$	8.135	3.476	9.322	4.039	7.980	3.417	9.121	3.932
	(8.846)	(6.794)	(8.875)	(6.803)	(8.845)	(6.790)	(8.873)	(6.798)
Estimated new jobs at application$_i$/offer$_i$	2.052	2.062	2.051	2.053	2.052	2.062	2.050	2.053
	(0.075)***	(0.066)***	(0.075)***	(0.067)***	(0.075)***	(0.066)***	(0.075)***	(0.066)***
Estimated safeguarded jobs at application$_i$/offer$_i$	0.975	1.148	0.978	1.147	0.972	1.139	0.974	1.137
	(0.054)***	(0.048)***	(0.054)***	(0.048)***	(0.054)***	(0.048)***	(0.054)***	(0.048)***
Capital costs £1000$_i$	0.071	0.054	0.071	0.054	0.071	0.054	0.071	0.054
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Firm characteristics								
Dummy multi-plant firm$_i$	28.347	15.675	28.614	16.040	28.411	15.919	28.574	16.229
	(4.971)***	(3.892)***	(4.976)***	(3.894)***	(4.976)***	(3.894)***	(4.986)***	(3.899)***
Total firm employment$_i$	0.009	0.004	0.009	0.004	0.009	0.004	0.009	0.004
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Foreign-owned MNE$_i$	78.955	50.278	77.539	49.266	79.368	50.998	77.962	49.984
	(10.677)***	(8.369)***	(10.686)***	(8.373)***	(10.681)***	(8.369)***	(10.689)***	(8.371)***
Entrant$_i$	−5.635	−6.036	−6.028	−6.402	−5.545	−5.910	−5.901	−6.256
	(4.374)	(3.422)*	(4.374)	(3.421)*	(4.374)	(3.421)*	(4.375)	(3.420)*
Plant employment growth$_i$	−0.892	−0.696	−0.921	−0.726	−0.896	−0.709	−0.927	−0.740
	(0.725)	(0.567)	(0.724)	(0.567)	(0.725)	(0.567)	(0.724)	(0.567)
Industry characteristics								
Investment per worker$_{st\text{-}1}$	2.475	0.676	2.510	0.723	2.514	0.725	2.559	0.781
	(0.860)***	(0.673)	(0.859)***	(0.673)	(0.861)***	(0.673)	(0.861)***	(0.673)

(continued)

Table 2. Continued

Dependent variable	(1)		(2)		(3)		(4)	
	Application	Offer	Application	Offer	Application	Offer	Application	Offer
Skilled/unskilled worker wage bill ratio$_{st\text{-}1}$	12.956	24.493	17.415	29.794	12.946	25.423	17.614	30.882
	(31.387)	(24.551)	(31.480)	(24.616)	(31.416)	(24.562)	(31.493)	(24.613)
Mean plant age$_{st\text{-}1}$	0.174	0.531	0.162	0.531	0.185	0.614	0.153	0.596
	(1.211)	(0.947)	(1.211)	(0.947)	(1.215)	(0.950)	(1.215)	(0.949)
Mean employment growth$_{st\text{-}1}$	4.477	1.793	4.473	1.857	4.602	2.018	4.643	2.114
	(5.709)	(4.466)	(5.705)	(4.461)	(5.709)	(4.464)	(5.705)	(4.459)
Area characteristics								
Dummy Tier 1 Assisted Area$_{rt}$	39.822	29.084	37.493	26.727	40.216	29.275	37.650	26.791
	(6.323)***	(4.942)***	(6.856)***	(5.359)***	(6.363)***	(4.972)***	(6.859)***	(5.359)***
Maximum grant rate$_{rt}$	129.488	110.463	134.506	116.654	127.898	109.212	133.549	115.804
	(42.093)***	(32.913)***	(43.026)***	(33.636)***	(42.150)***	(32.944)***	(43.031)***	(33.623)***
Real industry wage$_{srt\text{-}1}$	−0.014	0.701	−0.101	0.610	0.003	0.727	−0.099	0.624
	(0.580)	(0.454)	(0.587)	(0.459)	(0.580)	(0.454)	(0.587)	(0.459)
Claimant count rate$_{rt\text{-}1}$	−12.617	−12.647	−14.773	−9.562	−12.605	−12.653	−14.842	−9.793
	(3.577)***	(2.792)***	(8.917)*	(6.974)	(3.577)***	(2.790)***	(8.918)*	(6.970)
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	No	No	Yes	Yes	No	No	Yes	Yes
Observations	4264	4264	4264	4264	4264	4264	4264	4264
R^2	0.74	0.75	0.74	0.75	0.74	0.75	0.74	0.75
Test statistics								
Equality of EG index$_{st\text{-}1}$ coefficients	χ^2 (1) = 0.03		χ^2 (1) = 0.05		χ^2 (1) = 0.58		χ^2 (1) = 0.51	
	P > χ^2 = 0.865		P > χ^2 = 0.821		P > χ^2 = 0.447		P > χ^2 = 0.473	
Equality of Industry peripherality$_{srt\text{-}1}$ coefficients					χ^2 (1) = 0.43		χ^2 (1) = 0.43	
					P > χ^2 = 0.513		P > χ^2 = 0.512	
Equality of Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$ coefficients					χ^2 (1) = 2.11		χ^2 (1) = 2.14	
					P > χ^2 = 0.147		P > χ^2 = 0.143	

Note: ***, **, * significant at the 1%, 5%, 10% level. Standard errors in parentheses. Estimation sample: 4264 applications to English regional policy authorities. Variables are defined in Section 2.2. All regressions contain a constant (not reported). Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

In specifications (3) and (4) of Table 2 we include our measure of industry peripherality and the interaction term between this measure and the EG index. The coefficient on the interaction term allows us to distinguish between Predictions 2 and 3. In both specifications the coefficients on the interaction term in the application and offer equations are negative, and they are statistically significant in the offer equations. The tests at the foot of the table also show that the coefficients on the interaction terms in the application and offer equations are not significantly different from each other. In turn the coefficients on the EG index never indicate a statistically significant positive relationship as would be suggested by Predictions 1 and 2. If anything, the evidence points towards a negative relationship between an increase in the EG index and the amount offered per job.

These findings imply that once we allow the application and offer per job to vary with both the degree of industry localisation and distance from industry employment, plants in more agglomerated industries apply for, and are offered, higher subsidies in locations that are *closer* to the mass of existing industry employment. This lends strong support to Prediction 3 over Prediction 2. Between the two opposing predictions of the two theoretical settings, therefore, the data support the capture model as being dominant.[31]

As a second exercise to explore the discriminatory Predictions 2 and 3, we estimate an alternative specification of the offer equation. In Table 3, the dependent variable remains the amount offered, but we now directly condition on the amount applied for. To the extent that there exist unobservables which affect both the application and offer amounts in the same way, these will be controlled for when we condition on the application amount. This control variable evidently is not fully exogenous, and hence the estimates reported in Table 3 do not have a clean causal interpretation. We nonetheless consider this as a useful parsimonious complement to our SUR estimations.

The results in columns (1) and (2) of Table 3 for our sample of applications to English regional authorities imply that conditional on other characteristics the amount offered corresponds to some 61% of that applied for. The coefficients on the interaction of the EG index with the industry peripherality measure are in line with the results in Table 2. In both columns, with and without the policy authority dummies, we find results that directly contradict Prediction 2: firms in fact receive higher offers, conditional on the amount they applied for, in areas that are closer to industry employment. The results in column (2) indicate that at the mean value of industry peripherality, an increase in the EG index of 1 standard deviation would result in a decrease in the per-job offer of £1744, or around 40% of the average per-job offer. Figure 1 plots the marginal effect of a 1 standard deviation increase in the EG index across the entire distribution of the industry peripherality measure (the figure uses the standardised measure, with the most negative

31 Appendix Table D3 reports robustness checks on the results in Table 2. The first two specifications use alternative measures of industry peripherality. In (1) we measure industry peripherality as the percentage of industry employment in TTWAs located outside a 50-km radius from the centre of the TTWA in which the application is made, and in (2) as the percentage of industry employment outside the TTWA in which the application is made. In all remaining specifications industry peripherality is defined as in Table 2. In (3) we also include a proxy for urbanisation: standardised total manufacturing employment in TTWAs located within a 25km radius from the centre of the TTWA in which the application is made. In (4) we include TTWA dummies rather than policy authority dummies. In (5) we exclude the two-digit industry dummies, and in (6) we drop the set of Enterprise Grants. In all six specifications the main conclusions from Table 2 remain unaltered. We discuss the results shown in (7) and (8) in Section 4.2. We also ascertained robustness to using a 5-year window for matching grant applications to the plant population data (see Appendix A for more detail on data matching).

Table 3. Offer, conditional on application amount: variation by policy authority

Dependent variable: offer amount £1000	English regions		National governments		All authorities	
	(1)	(2)	(3)	(4)	(5)	(6)
Application amount £1000	0.615	0.614	0.712	0.725	0.715	0.725
	(0.027)***	(0.027)***	(0.046)***	(0.046)***	(0.036)***	(0.038)***
EG index$_{st\text{-}1}$	−1.615	−1.744	1.222	3.096	−2.155	−2.030
	(0.895)*	(0.896)*	(4.034)	(4.109)	(1.774)	(1.674)
Industry peripherality$_{srt\text{-}1}$	1.442	1.429	2.765	−7.182	3.490	0.248
	(1.164)	(1.533)	(10.947)	(8.228)	(1.850)*	(2.323)
Industry peripherality$_{srt\text{-}1}$	−0.938	−0.981	1.487	3.003	−0.712	−0.398
× EG index$_{st\text{-}1}$	(0.375)**	(0.378)***	(1.543)	(1.299)**	(0.360)**	(0.424)
Offer characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	No	Yes	No	Yes	No	Yes
Observations	4264	4264	1690	1690	5954	5954
R^2	0.90	0.90	0.84	0.84	0.86	0.86

Note: Robust standard errors, two-way clustered at the five-digit industry and TTWA level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. Estimation sample: 4264 applications to English regional policy authorities, columns (1) and (2), to the English national authority and to Wales and Scotland, columns (3) and (4), and to the full sample, columns (5) and (6). All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 2.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).

values on the *X*-axis indicating a relatively small number of areas closest to industry employment). The relationship is clearly negative, and statistically significant in areas with very low or very high shares of industry employment—the opposite of Prediction 2.[32]

In sum, of the two contradictory Predictions 2 and 3, it is Prediction 3 that is supported by the data for the set of applications to the English regional authorities, consistent with policy capture rather than the economic geography mechanism. Hence, while both may still play a role, policy capture seems to be the dominant force at the subnational level. We investigate this further below, by examining whether the data support the two complementary hypotheses, Predictions 4 and 5, with regard to policy capture.

4.2. Policy capture

We start by examining Prediction 4, which implies that local policy authorities will be more susceptible than national governments to policy capture by locally active firms. We contrast our sample of applications to the English regional authorities with the

32 We obtain the same pattern of results with negative and statistically significant coefficients on the EG index and on the interaction term if we estimate with the application amount, offer amount and capital costs variables expressed in logs.

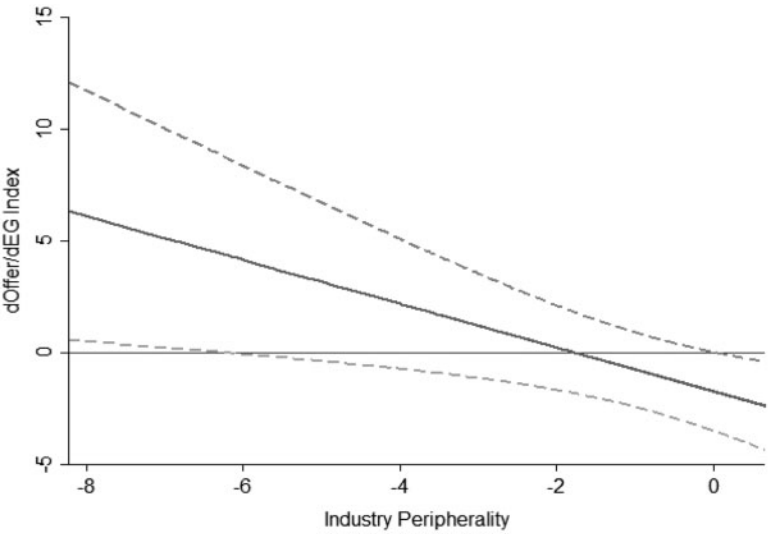

Figure 1. Effect of a one standard deviation change in EG index on the offer per job across the distribution of industry peripherality.
Note: Derived from the results in column (2) of Table 3, using standardised measures of the EG index and industry peripherality (mean zero, standard deviation 1). dOffer/dEG index shows the change in the offer per job (in £1000) of a 1 standard deviation (one unit) increase in the EG index. Dashed lines show 95% confidence intervals.
Source: authors calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).

sample of applications dealt with by the national agencies (England, Wales, Scotland), and with the full sample. Columns (3)–(6) of Table 3 repeat the specifications in the first two columns. Comparison of the sample of applications to the English regions to the sample of applications to the national authorities reveals that, conditional on other characteristics, on average applicants to the English regions are offered a lower fraction of the value of their application (61% versus 72% at the national level).

Most importantly, we find that the negative coefficient on the interaction of central interest, found previously in columns (1) and (2), is confined to applications made to the English regions, whereas a positive, and in the presence of the policy authority dummies statistically significant, effect is observed for applications administered at the national level (columns (3) and (4)).[33] Hence, for applications to the national policy authorities, although again both mechanisms may be at work, the pattern of offers appears to be more in line with that suggested by economic geography models.

When we pool the data, in columns (5) and (6), the negative interaction effects again dominate. That this pattern is driven by applications to the regional authorities is supported by a comparison of these final two columns, where the negative coefficient on the interaction term becomes less negative and loses statistical significance once we

33 The inclusion of the policy authority dummies for Wales and Scotland (peripheral regions) versus the English national government (which only administers very high value applications) leads to substantial changes in the coefficients on EG index and the interaction term between EG and the industry peripherality measure.

control for the policy authority dummies. Our results are therefore consistent with Prediction 4, whereby it is lower tier governments that are more generous to firms in agglomerated sectors, when the industry in which the firm operates is more spatially concentrated in the location in which the application is made.

As further checks, the final two specifications in Table D3 in the Appendix estimate the seemingly unrelated regression specifications (Equations (5) and (6)) for the sample of applications to the national policy authorities and for a separate sample of applications by foreign-owned firms only. These are both more supportive of the economic geography hypothesis, suggesting—in line with the theory—that capture is less of an issue at higher levels of government and for non-national firms.

Next, we explore Prediction 5, which implies that incumbent firms (as opposed to new entrants) and firms in declining industries will attract higher per-job subsidies. In Table 4, we return to our main sample of applications made to the English regions and split it into applications that only involve the creation of new jobs and those that offer to safeguard existing jobs at an established site, where the latter group will be incumbent firms, and since they are applying to safeguard existing jobs more likely to be in decline.

We replicate the specification from column (2) of Table 3. In column (1) of Table 4, we consider applications that only involve job creation. This group can include entrants and since they are not applying to safeguard jobs we assume that they are less likely to be in decline. In column (2) we consider those that involve only job creation (as in column (1)) or a combination of job creation and job safeguarding. In column (3) we consider a set of incumbent firms: applications that involve only job safeguarding or a combination of job creation and job safeguarding (there are too few applications that only safeguard jobs to consider these alone). From the policy rules, the jobs being supported by the subsidy must be 'marginal', in the sense that in the absence of the public subsidy and new investment they would be lost; hence the firms in the estimation sample in column (3) can be considered as in decline.

We find negative and statistically significant coefficients on the interaction terms between industry peripherality and the EG index in columns (2) and (3), with a stronger relationship in column (3) for those grant applications that include some component of job safeguarding. These results support Prediction 5: declining incumbent firms in more agglomerated areas are more successful at attracting subsidies than firms that are exclusively creating new jobs, a set which encompasses new entrants.

In Table 5, we cut the sample of applications to English regions according to a measure of average plant employment growth in the industry-TTWA in the year prior to the application being made. The first two columns replicate the specification of column (2) in Table 3 for applications in industry-areas with below median employment growth and the final two columns for applications in industry-areas with above median employment growth. In each case, we estimate the model separately for all applications and the subset which include an element of job safeguarding. The results suggest that the more generous behaviour on the part of the policy authorities to applicants in more locally agglomerated industries is confined to cases where industry-area employment is in relative decline and is again stronger in the case of applications that propose to safeguard existing jobs. Hence, these findings provide further support for Prediction 5 and thus the policy capture mechanism.

As a final robustness check on Predictions 3 to 5, we split the sample of applications to the English regions according to a measure of the extent to which the TTWA in

Table 4. Offer, conditional on application amount: applications to create versus safeguard jobs

Dependent variable offer amount £1000	Application type		
	Job creation only (1)	Job creation only + Job creation and safeguarding (2)	Job safeguarding only + Job creation and safeguarding (3)
Application amount £1000	0.630	0.592	0.615
	(0.054)***	(0.026)***	(0.030)***
EG index$_{st\text{-}1}$	−1.003	−1.659	−1.592
	(1.694)	(0.940)*	(2.147)
Industry peripherality$_{srt\text{-}1}$	−0.152	0.398	5.225
	(0.868)	(1.601)	(3.418)
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$	−0.023	−0.448	−2.448
	(0.239)	(0.212)**	(1.050)**
Offer characteristics	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes
Observations	2685	4047	1579
R^2	0.91	0.89	0.90

Note: Robust standard errors, two-way clustered at the five-digit industry and TTWA level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. Estimation samples: subsets of applications to English regional policy authorities, as defined by the column headings. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 2.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).

which the application is made is specialised in the respective industry, measured in year $t-1$.[34] We again consider separately grant applications that involve some job safeguarding and must therefore be made by incumbent plants in decline. The results, shown in Table 6, suggest that the more generous behaviour on the part of the policy authorities is confined to cases where the area is relatively specialised in the industry and is stronger in the case of applications that are to safeguard existing jobs. Figure 2 shows clearly that for highly specialised industry-areas, columns (1) and (2), the marginal effect on the offer per-job of a change in the EG index is decreasing in industry peripherality, and positive and statistically significant at very low values, that is, in areas with a high share of industry employment. In contrast, this is not the case for the results in columns (3) and (4), where the marginal effect is never statistically significantly different from zero across the whole distribution. Hence, these results further support Predictions 3 to 5 associated with models of policy capture.

Is the policy capture hypothesis, supported as it is by our estimation results, plausible in the context of British policy institutions? Independent assessment of the application

34 We measure specialisation by: (employment$_{srt}$ / employment$_{rt}$)/ (employment$_{st}$ / employment$_{t}$), where s, r and t are five-digit industry, TTWA and year, respectively.

Table 5. Offer, conditional on application amount: low versus high industry-area employment growth

Dependent variable: offer amount £1000	Bottom 50% by industry-area employment growth		Top 50% by industry-area employment growth	
	All	Some job safeguarding	All	Some job safeguarding
	(1)	(2)	(3)	(4)
Application amount £1000	0.596	0.572	0.608	0.611
	(0.034)***	(0.036)***	(0.045)***	(0.054)***
EG index$_{st\text{-}1}$	−1.399	−0.871	−1.629	−0.872
	(1.975)	(5.258)	(1.146)	(1.936)
Industry peripherality$_{srt\text{-}1}$	3.901	9.389	−1.288	−0.702
	(2.373)	(4.776)**	(1.373)	(2.708)
Industry peripherality$_{srt\text{-}1}$	−1.386	−3.447	0.129	−0.013
× EG index$_{st\text{-}1}$	(0.412)***	(1.330)***	(0.342)	(0.676)
Offer characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes
Observations	2132	801	2132	778
R^2	0.90	0.91	0.90	0.90

Note: Robust standard errors, two-way clustered at the five-digit industry and TTWA level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. Estimation samples: applications to English regional policy authorities, split according to column headings. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 2.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS)

process and receipt of RSA grants has pointed out that subsidies were being awarded repeatedly to the same incumbent firms. The National Audit Office (2003), an independent body which evaluates public spending within England, described the RSA policy as 'demand-led', with the scheme being publicised to firms via brochures, and websites.[35] However, they expressed concern about the tendency for some firms to receive multiple grants over time, stating that 'between April 1994 and March 2002, of all companies accepting grant offers, 12 percent had received more than one grant, amounting to 31 percent of the total value of offers accepted' (National Audit Office, 2003, 21), and suggested that applying for a grant may become a 'business skill' potentially biasing the system in favour of previously successful applicants. To corroborate this for our data, we present an analysis of repeat applications to the English regional policy authorities in Appendix B.3. In line with our conclusions the results are indeed suggestive that plants in more agglomerated industries that are closer to industry employment are more likely to be owned by firms that make multiple applications.[36]

35 The programme was not actively marketed to firms in specific targeted sectors or geographic areas, as EU rules stipulated that such policies must be available equally across eligible sectors.
36 Criscuolo et al. (2012) also discuss the possibility of 'gaming' within the RSA scheme, by larger (higher employment), multi-plant firms, suggesting that the lack of evidence for additionality among these firms

Table 6. Offer, conditional on application amount, industry specialised versus non-specialised areas

Dependent variable: offer amount £1000	Top 50% by area-industry specialisation		Bottom 50% by area-industry specialisation	
	All (1)	Some job safeguarding (2)	All (3)	Some job safeguarding (4)
Application amount £1000	0.594	0.592	0.688	0.648
	(0.021)***	(0.025)***	(0.065)***	(0.073)***
EG index$_{st\text{-}1}$	−2.361	−4.572	−0.352	2.377
	(1.551)	(3.519)	(0.948)	(1.701)
Industry peripherality$_{srt\text{-}1}$	4.265	12.221	−2.180	−5.108
	(2.911)	(7.109)*	(0.809)***	(2.035)**
Industry peripherality$_{srt\text{-}1}$	−2.058	−5.518	0.045	0.479
× EG index$_{st\text{-}1}$	(0.606)***	(1.616)***	(0.094)	(0.326)
Offer characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes
Observations	2144	879	2120	700
R^2	0.90	0.90	0.90	0.92

Note: Robust standard errors, two-way clustered at the five-digit industry and TTWA level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. Estimation samples: applications to English regional policy authorities, split according to column headings. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 2.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).

5. Conclusions

We exploit plant-level administrative data on a regional investment subsidy programme in Great Britain to study policy responses to the presence of localisation economies, pitting the predictions of economic geography models against those of models of policy capture. At the subnational level, we find that, conditional on the amount applied for by firms, governments offer more generous subsidies to firms in more agglomerated industries in areas with a higher density of industry employment. This phenomenon is most pronounced for applications aimed at safeguarding existing jobs, and for applications in areas where employment in the respective industry is in relative decline. Taken together, these results are in line with theories of policy capture by incumbent local industries, and they run against the 'taxable agglomeration rents' result of economic geography models. This implies that policy capture has greater explanatory power

might be due to their ability to re-locate employment across plants. Their findings are consistent with ours since many larger, multi-plant employers do make applications to the English regional policy authorities. Table 1 indicates that 30% of applicants to the English regional authorities are multi-plant firms; the corresponding figure for our national policy authority sample is 41%.

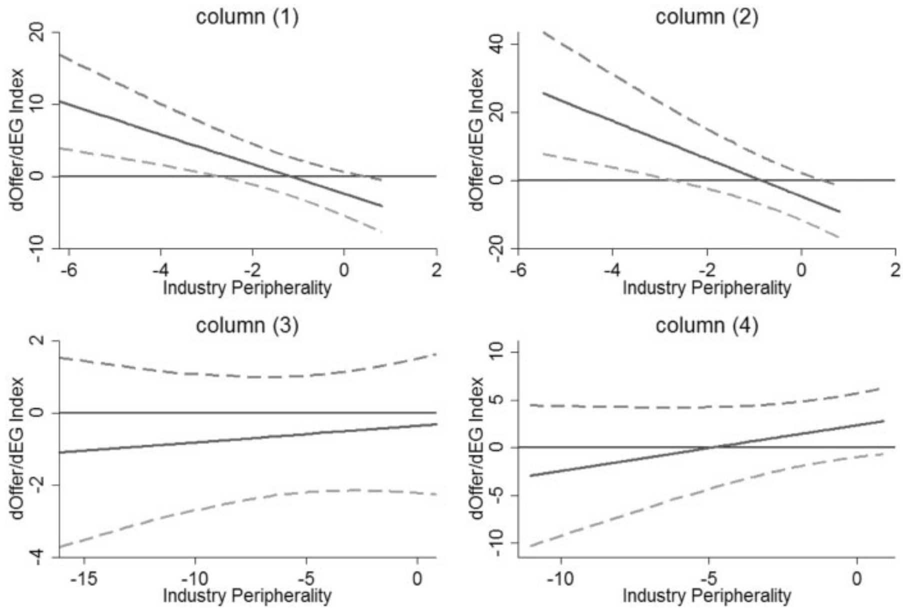

Figure 2. Marginal effect of a one unit change in EG index on the offer per-job: industry specialised versus non-specialised areas.
Note: Derived from the results in Table 6, using standardised measures of the EG index and industry peripherality (mean zero, standard deviation 1). dOffer/dEG index shows the change in the offer per job (in £1000) of a 1 standard deviation (one unit) increase in the EG index. Dashed lines show 95% confidence intervals.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).

for the structure of subnational government grant awards, even though the forces identified in economic geography models may also be at play. Indeed, we find that for grant awards decided by national policy authorities the pattern of applications and offers conforms to a greater extent with the qualitative predictions of economic geography models.

On the face of it, our finding that subsidies offered by lower tier authorities are more generous in areas that host the industry's agglomeration is consistent with another explanation: local jurisdictions could be using subsidies to attract plants that might themselves generate significant agglomeration externalities for the area, and such external benefits could be more pronounced in locations that are already relatively specialised in an applicant's industry (Greenstone et al., 2010; Moretti, 2010). However, we consider this an improbable explanation for the pattern of grant offers we observe. First, agglomeration benefits running from applicant plants to firms in the surrounding area (rather than the other way around) are likely to be an issue only for relatively large projects. This plausibly holds in the case of the 'million dollar plants' studied by Greenstone et al. (2010), but not in our policy setting, where the projects at stake are some two orders of magnitude smaller.[37] Secondly, we find that these more generous offers are made to incumbent plants applying

37 The average plant in Greenstone et al. (2010, 555) accounted for close to 3 million labour hours, which translates into some 1600 full-time jobs, whereas in our sample the average grant offer was associated with an estimated 16 new or 10 safeguarded jobs (see Table 1).

to safeguard existing jobs but not to entrants creating new jobs. This asymmetric treatment by policy authorities cannot be readily explained by a model with agglomeration effects.

Our results are reminiscent of prior findings whereby subsidy policies ostensibly targeted at growth sectors in fact are geared heavily towards industries and regions in relative decline (Beason and Weinstein, 2005; Martin et al. 2011), and they support the view that the optimal degree of fiscal decentralisation is contingent on the extent to which policy may be subject to capture by dominant entrenched local interests (Bardhan, 2002). The normative relevance of such policy capture has been emphasised, among others, by Glaeser (2002, 28), for whom, among the conceivable reasons why local jurisdictions offer fiscal inducements to mobile firms, the 'corruption and influence story' is 'the only theory that suggests that tax incentives would create spatial distortions'. To our knowledge, however, no formal model exists that combines firm-level agglomeration economies with lobbying and fiscal federalism. This could offer a fruitful opening for future research.

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Appendix

A. Matching the grants data to the ARD

We use information provided by the UK Department of Business, Innovation and Skills (BIS) to link the RSA and Enterprise Grant applicants to the ARD data. BIS have matched the grants data to the Inter-Departmental Business Register (IDBR) which is the population underlying the ARD using information including postcodes and company names. We restrict our analysis to applications in the manufacturing sector between 1985 and 2004 and also to applications which received an offer, reported a positive number of jobs to be created or safeguarded in the data and were not withdrawn, of which there are 21,270 applications. In addition, we have a further 4438 applications for which the industry code information is missing in the application information which we try to match. We therefore begin with 25,708 applications.

Matching information is provided for 20,876 (or 82%). However, the grants data can be matched into the ARD data at various levels of aggregation; for example, directly to single site plants, to establishments (that in principle can comprise more than one plant under common ownership at different locations) or at the firm level, which means that the grant application is matched to all plants within the firm (which can total over 100 sites). In some cases, applications are also matched to multiple plants or establishments, that which are not unique. Because the precise location of the site associated with the application is a crucial factor in our analysis, we restrict our estimation sample to applicants where the match is at the plant or establishment level. This leaves a set of 12,887 potential grant applications over the period 1985–2004 to be matched. We are able to match 9379 (73%) into unique plants or establishments in the manufacturing sector in ARD data between 1984 and 2006. (For those applications where we knew that the application was to the manufacturing sector the match rate is higher at 81%.)

Matches at the establishment level may still entail matching to multiple plants at more than one site, but they will be operating in the same industry. To attribute a location, we both ensure that the location we attribute to the grant application is within an Assisted Area, and select the modal TTWA, and the modal value of other characteristics across the plants within an establishment.

We then restrict our analysis to matches within 3 years of the application date leaving 6185 applications. We are unable to use the 1984 matches in our estimates, as lagged values of our location specific variables are unavailable. Once missing data, for example, on jobs associated with the application are accounted for, and the top and bottom percentile of observations by grant value are eliminated (due to implausible outlier values), our final sample comprises 5954 applications. Of these 4264 are the applications to English regional policy authorities.

We ran probit models to check that there were no systematic relationships between the probability of matching a grant and the value of the EG index for the respective industry, and also the application amount per job. The results of these exercises are reported in the Table below. We find little evidence that the probability of a match is related in a systematic way to the agglomeration intensity of the industry or the application amount per job. We ascertain that this is the case both for the full sample of grants to any policy authority and the subset applying to English regional policy authorities. For applications to the English regional authorities, because we need to know the location of the plant for which the application is made, we can only consider those applications from the population that in principle are matched at the plant or establishment level, and for which the postcode information supplied can be meaningfully matched to a region of England.

A.1. Matched applications

Dep var =1 if grant application is in estimation sample	All applications		Applications to English regional authorities	
	(1)	(2)	(3)	(4)
EG index$_{st\text{-}1}$	−0.008	0.0001	−0.006	0.005
	(−2.65)***	(0.02)	(−1.16)	(0.82)
Application year dummies	No	Yes	No	Yes
Observations	21,848	21,848	8282	8282
Dep var =1, if grant application is in estimation sample	**All applications**		**Applications to English regional authorities**	
	(1)	(2)	(3)	(4)
Application amount per job$_{it}$	0.0001	0.0003	0.0006	0.0015
	(0.20)	(0.82)	(0.58)	(1.36)
Application year dummies	No	Yes	No	Yes
Observations	21,848	21,848	8282	8282

Note: Table shows marginal effects from a probit model with z-statistics in brackets. Matched sample is before excluding the top and bottom percent of observations by grant value. For the all grants sample, the number of observations is fewer than 25,708 due to missing information on industry codes/EG index. For applications to the English regional authorities the number of observations represents the subset of the applications that are made to English regional policy authorities, based on application value and location. ***, **, * significant at the 1%, 5%, 10% level.

B. Grant applications

B.1. Selection into application

We consider whether the characteristics of those plants to which we match an application, differ systematically from the overall population of potential applicants. This latter population is not observed, since it would include new entrants, including new plants set up by firms outside Assisted Areas and foreign multinationals setting up new plants. We proxy the potential applicant pool using the set of existing plants in each year located in Assisted Areas.

We examine whether there are differences in application rates across plants in more or less agglomerated industries, in locations more remote from industry employment and the interaction between these two variables. We estimate simple probit models where the dependent variable takes the value of 1 if plant i is ever matched to a grant application over the sample period. Although we observe a negative correlation between making an application and remoteness from industry employment, there is no evidence that this additionally varies by the degree to which the industry is agglomerated and little evidence that the degree to which the industry is agglomerated is related to the probability of making an application.

B.1.1 Application

Dep var =1, if plant ever makes an application	(1)	(2)	(3)	(4)	(5)	(6)
EG index$_{st\text{-}1}$	−0.003	−0.001	−0.0006	−0.004	−0.002	−0.001
	(−1.02)	(−0.92)	(−0.54)	(−1.35)	(−1.32)	(−1.07)
Industry peripherality$_{srt\text{-}1}$				−0.004	−0.002	−0.001
				(−2.18)**	(−3.93)***	(−2.42)**
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$				0.0007	−0.00005	−0.00002
				(1.38)	(−0.24)	(−0.17)
Year dummies	No	Yes	Yes	No	Yes	Yes
Two-digit industry dummies	No	No	Yes	No	No	Yes
Observations	443,407	443,407	443,407	443,407	443,407	443,407

Note: Table shows marginal effects with z-statistics in brackets. Standard errors are clustered at the two-digit industry level. Year dummies are defined using the average year between 1985 and 2006 which the plant is observed in the sample. 10,160 plants are matched as ever making an application, as in this exercise we do not condition on positive offers and jobs associated with the offer, or whether or not the application was subsequently withdrawn. ***, **, * significant at the 1%, 5%, 10% level.

B.2. Application to the English regional versus English national authorities

In the next table we examine selection into application to the English regional authorities versus the national policy authority for England. To do this we use a set of matched applications whose value falls in a band around the threshold which determines whether or not the application is dealt with at the national level. Up until 1996 this was applications over £1 million, rising to £2 million in 1996. We use two samples, applications within £500,000 of the threshold and those within £750,000 of the threshold. The table below reports the results of running a probit regression where the dependent variable takes the value one if the application is to the English regional authorities. We find little to no evidence of selection into applying to the lower tier policy authorities according to our main variables of interest.

B.2.1 Application to English regional versus English national authorities

Dep var =1 if plant applies to regional authorities	Within £500k of threshold				Within £750k of threshold			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EG index$_{st\text{-}1}$	−0.006	0.021	−0.035	0.006	−0.003	0.00004	−0.001	−0.006
	(−0.22)	(0.59)	(−0.69)	(0.11)	(−0.17)	(−0.00)	(−0.05)	(−0.24)
Industry peripherality$_{srt\text{-}1}$			−0.043	−0.030			−0.038	−0.038
			(−1.22)	(−0.73)			(−2.04)**	(−1.86)*
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$			0.022	0.039			0.008	0.009
			(0.38)	(0.54)			(0.57)	(0.81)
Year dummies	No	Yes	No	Yes	No	Yes	No	Yes
Observations	174	143	174	143	301	253	301	253

Note: Tables show marginal effects with z-statistics in brackets. Year dummies are defined using the application year. ***, **, * significant at the 1%, 5%, 10% level.

B.3. Repeat applicants to English regional authorities

We identify applicant plants which belong to firms that make multiple applications to the English regional authorities during our estimation period. In the table below, in columns (1)–(4), we run a linear regression where the dependent variable is the count of applications made by the firm which owns each plant over the estimation sample period. In columns (5)–(8), we estimate probit models where the dependent variable takes the value 1 when the plant is owned by a firm that makes multiple applications. In both cases we find evidence to suggest that plants in more agglomerated industries located in areas closer to industry employment are more likely to be owned by firms that make more than one application.

B.3.1 Multiple applications to the English regional authorities

	Dep var = count of applications to regional authorities made by the firm which owns the plant				Dep var =1, if plant owned by a firm that applies to regional authorities more than once			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EG index$_{st\text{-}1}$	0.006	0.002	0.028	0.024	−0.003	−0.004	0.005	0.005
	(0.009)	(0.009)	(0.013)**	(0.013)*	(−0.59)	(−0.76)	(0.69)	(0.65)
Industry peripherality$_{srt\text{-}1}$			0.003	−0.001			−0.001	−0.001
			(0.011)	(0.011)			(−0.11)	(−0.15)
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$			−0.007	−0.007			−0.005	−0.005
			(0.003)**	(0.003)**			(−1.61)	(−1.75)*
Year dummies	No	Yes	No	Yes	No	Yes	No	Yes
Observations	4270	4270	4270	4270	4270	4270	4270	4270

Note: Table shows marginal effects with standard errors in brackets (columns (1)–(4)) and *z*-statistics in brackets (columns (5)–(7)). Year dummies are defined using the application year. ***, **, * significant at the 1%, 5%, 10% level.

C. Grant offer acceptance

Using the population of applications, a very high proportion, around 88% receive an offer. Of those that receive an offer 92% accept.

Our main sample contains a set of applications all of whom receive an offer, and which we can successfully match to the ARD. For our estimation sample, both the full sample and the sample of applications to English regional policy authorities, 95% of the offers are accepted (we would not observe greenfield entrants who did not accept, and chose never to enter). The tables below show marginal effects from a probit model relating the probability of acceptance to our main variables of interest, for the full sample and the sample of applications to the English regional authorities.

C.1. Acceptance

Dep var =1, if grant offer is accepted	All grants			
	(1)	(2)	(3)	(4)
EG index$_{st\text{-}1}$	0.006	0.003	0.004	0.002
	(1.20)	(0.79)	(0.94)	(0.56)
Industry peripherality$_{srt\text{-}1}$	0.005	0.007	0.007	0.002
	(1.36)	(2.20)*	(2.17)**	(0.46)
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$	0.001	0.0004	0.0004	0.0005
	(1.57)	(0.61)	(0.59)	(0.99)
Year dummies	No	Yes	Yes	Yes
Two-digit industry dummies	No	No	Yes	Yes
Policy authority dummies	No	No	No	Yes
Observations	5954	5954	5946	5946
Dep var =1, if grant offer is accepted	**English regions**			
	(1)	(2)	(3)	(4)
EG index$_{st\text{-}1}$	0.006	0.003	0.004	0.002
	(0.89)	(0.63)	(0.81)	(0.48)
Industry peripherality$_{srt\text{-}1}$	0.005	0.007	0.009	0.004
	(1.02)	(1.59)	(1.90)*	(0.81)
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$	0.002	0.001	0.0004	0.001
	(1.38)	(0.69)	(0.52)	(0.70)
Year dummies	No	Yes	Yes	Yes
Two-digit industry dummies	No	No	Yes	Yes
Policy authority dummies	No	No	No	Yes
Observations	4264	4264	4257	4257

Note: Tables show marginal effects with *z*-statistics in brackets. Standard errors are clustered at the five-digit industry level. Some observations are dropped from the sample in columns (3) and (4) due to lack of variation within two-digit industries. ***, **, * significant at the 1%, 5%, 10% level.

Appendix Tables

Table D1. Dummy variables for percentiles of EG index top 10%, 25%, 50% SUR application and offer

Dependent variable:	(1)		(2)		(3)	
	Application	Offer	Application	Offer	Application	Offer
EG top 10%tile	8.285	1.443				
	(7.157)	(5.598)				
EG top 25%tile			5.450	0.272		
			(5.578)	(4.363)		
EG top 50%tile					8.111	9.035
					(5.122)	(4.004)**
Application/offer characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4264	4264	4264	4264	4264	4264
R^2	0.74	0.75	0.74	0.75	0.74	0.75
Test statistics						
Equality of EG top X%tile coefficients	χ^2 (1) = 1.86		χ^2 (1) = 1.75		χ^2 (1) = 0.07	
	P > χ^2 = 0.173		P > χ^2 = 0.186		P > χ^2 = 0.797	

Note: ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 2. Estimation sample: 4264 applications to English regional policy authorities.
Source: Authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).

Table D2. Total value of offers—industry-level: applications to English regional authorities

Dependent variable: value of offers$_{st}$	(1)	(2)	(3)
EG index$_{st\text{-}1}$	−25.454	−13.645	−15.155
	(10.261)**	(9.936)	(10.005)
Total plants$_{st}$		0.063	
		(0.006)***	
Total firms$_{st}$			0.067
			(0.006)***
Investment in plant and machinery per worker$_{st\text{-}1}$	5.407	8.438	8.333
	(2.259)**	(2.256)***	(2.261)***
Skilled/unskilled worker wage bill ratio$_{st\text{-}1}$	−65.273	20.972	19.944
	(63.352)	(61.167)	(61.067)
Mean plant age$_{st\text{-}1}$	3.500	17.254	17.066
	(3.312)	(3.425)***	(3.431)***
Mean employment growth$_{st\text{-}1}$	−0.914	3.487	3.718
	(9.339)	(8.979)	(9.060)
Application year dummies	Yes	Yes	Yes
Observations	2131	2131	2131
R^2	0.04	0.13	0.12

Note: Robust standard errors in parentheses. ***, **, * significant at the 1%, 5%, 10% level. Estimation sample: 2131 observations at the five-digit industry-year level.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

Table D3. Robustness checks and extensions

	Industry peripherality (50-km radius)		Industry peripherality (within TTWA)		Controlling for urbanisation		Including TTWA dummies	
	(1)		(2)		(3)		(4)	
	Application	Offer	Application	Offer	Application	Offer	Application	Offer
EG index$_{st\text{-}1}$	−1.357	−3.298	−2.600	−4.366	−2.233	−3.747	−5.637	−5.357
	(3.126)	(2.443)	(3.117)	(2.436)*	(3.203)	(2.504)	(3.332)*	(2.574)**
Industry peripherality$_{srt\text{-}1}$	−2.040	−1.951	−6.758	−5.341	−4.977	−2.284	−5.606	−2.911
	(2.966)	(2.319)	(3.145)**	(2.458)**	(3.232)	(2.527)	(3.246)*	(2.508)
Industry peripherality$_{srt\text{-}1}$ × EG index$_{st\text{-}1}$	−0.767	−1.617	−0.045	−0.595	−0.394	−1.267	−0.670	−1.294
	(0.841)	(0.658)**	(0.463)	(0.362)*	(0.717)	(0.561)**	(0.759)	(0.587)**
Urbanisation$_{rt\text{-}1}$					−8.030	−4.655		
					(3.264)**	(2.552)*		
Characteristics controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Two-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Observations	4264	4264	4264	4264	4264	4264	4,264	4,264
R^2	0.74	0.75	0.74	0.75	0.74	0.75	0.75	0.77
Test statistics								
Equality of EG index$_{st\text{-}1}$ coefficients	χ^2 (1) = 0.78		χ^2 (1) = 0.65		χ^2 (1) = 0.45		χ^2 (1) = 0.01	
	P > χ^2 = 0.376		P > χ^2 = 0.419		P > χ^2 = 0.501		P > χ^2 = 0.906	
Equality of industry peripherality	χ^2 (1) = 0.00		χ^2 (1) = 0.41		χ^2 (1) = 1.41		χ^2 (1) = 1.37	
measure coefficients	P > χ^2 = 0.966		P > χ^2 = 0.521		P > χ^2 = 0.235		P > χ^2 = 0.242	
Equality of interaction coefficients	χ^2 (1) = 2.07		χ^2 (1) = 2.86		χ^2 (1) = 3.00		χ^2 (1) = 1.34	
	P > χ^2 = 0.150		P > χ^2 = 0.091		P > χ^2 = 0.083		P > χ^2 = 0.247	
Equality of urbanisation coefficients					χ^2 (1) = 2.17			
					P > χ^2 = 0.141			

Table D3. Robustness checks and extensions

	Omitting industry dummies		Excluding enterprise grants		Applicants to national policy authorities		Foreign only, applicants to all policy authorities	
	(5)		(6)		(7)		(8)	
	Application	Offer	Application	Offer	Application	Offer	Application	Offer
EG index$_{st\text{-}1}$	−0.872	−3.174	−2.646	−4.194	6.421	6.619	65.105	34.498
	(3.039)	(2.372)	(3.321)	(2.581)	(12.643)	(11.572)	(32.180)**	(31.483)
Industry peripherality$_{srt\text{-}1}$	−1.391	0.253	−1.395	0.381	−65.821	−51.866	−67.215	−59.449
	(2.889)	(2.255)	(3.251)	(2.527)	(14.231)***	(13.085)***	(36.744)*	(35.882)*
Industry peripherality$_{srt\text{-}1}$	−0.745	−1.550	−1.142	−2.005	9.092	10.346	27.854	16.928
× EG index$_{st\text{-}1}$	(0.684)	(0.534)***	(0.801)	(0.623)***	(4.171)**	(3.817)***	(13.421)**	(13.095)
Characteristics controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Two-digit industry dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4264	4264	3877	3877	1690	1690	411	411
R^2	0.74	0.75	0.74	0.76	0.61	0.61	0.63	0.65
Test statistics								
Equality of EG index$_{st\text{-}1}$ coefficients	χ^2 (1) = 1.16		χ^2 (1) = 0.43		χ^2 (1) = 0.00		χ^2 (1) = 0.91	
	P > χ^2 = 0.281		P > χ^2 = 0.511		P > χ^2 = 0.984		P > χ^2 = 0.341	
Equality of industry peripherality	χ^2 (1) = 0.66		χ^2 (1) = 0.59		χ^2 (1) = 1.51		χ^2 (1) = 0.04	
measure coefficients	P > χ^2 = 0.418		P > χ^2 = 0.442		P > χ^2 = 0.220		P > χ^2 = 0.833	
Equality of interaction coefficients	χ^2 (1) = 2.80		χ^2 (1) = 2.30		χ^2 (1) = 0.14		χ^2 (1) = 0.67	
	P > χ^2 = 0.094		P > χ^2 = 0.129		P > χ^2 = 0.705		P > χ^2 = 0.414	

Note: ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant. Characteristics controls: Application, Offer, Firm, Industry and Area as in Table 2. Urbanisation is defined as standardised total manufacturing employment in the set of TTWAs located within a 25-km radius from the centre of the TTWA in which the application is made. Estimation sample columns (1)–(5) 4264 applications to English regional authorities; columns (6)–(8) as defined in column headings. *Source*: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (Source BIS).